

November 16, 2010

NAME

Fluids-ID

Quiz 13. Water at 20°C ($\rho = 1.94 \text{ slug/ft}^3$ and $\mu = 2.09 \times 10^{-5} \text{ slug/ft}\cdot\text{s}$) is to be pumped through 2000 ft of pipe from reservoir 1 to 2 at a rate of 3 ft³/s. If the pipe is cast iron ($\varepsilon = 0.00085 \text{ ft}$) of diameter 6 in, what horsepower (1hp = 550 ft·lbf/s) pump is needed? (Note: $g = 32.2 \text{ ft/s}^2$)

- Energy equation:

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 + h_p = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + h_t + h_L \quad (1)$$

$$h_L = h_f = f \frac{L V^2}{d 2g} \quad (2)$$

$$\frac{1}{\sqrt{f}} = -1.8 \log \left[\left(\frac{\varepsilon/D}{3.7} \right)^{1.11} + \frac{6.9}{Re} \right] \quad (3)$$

